



Water Study



**WATER DISTRIBUTION SYSTEM
BASIS OF DESIGN REPORT
FOR
7th DAY ADVENTIST – SCOTTSDALE & SUTTON**

November 26, 2019
WP# 194966



EXPIRES 03-31-22

November 26, 2019

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City of Scottsdale
Planning and Development
7447 East Indian School Road
Scottsdale, Arizona 85257

480.312.5319

Re: **7th Day Adventist – Scottsdale & Sutton**
Water Distribution System Basis of Design Report
WP# 194966

To Whom It May Concern:

This Water Distribution System Basis of Design Report is prepared for Ryan A+E, Inc., and submitted to the City of Scottsdale. 7th Day Adventist – Scottsdale & Sutton (Site) consists of portions of two (2) adjacent parcels totaling an area of approximately 2,148,604 square-feet, or 49.3± acres, located at the northeast corner of North Scottsdale Road and Sutton Road in Scottsdale, Arizona. More specifically, the Site is located in a portion of Section 11, Township 3 North, Range 4 East and a portion of the north half of Section 14, Township 3 North, Range 4 East of the Gila and Salt River Base and Meridian. Refer to the *Vicinity Map* at the back of this report. The Site is bounded by Thunderbird Road/Redfield Road to the north, East Sutton Drive on the south, North Miller Road on the east and North Scottsdale Road on the west. The project will include construction of airport hangars, industrial buildings, office buildings, residential townhomes, and single family homes. Proposed improvements include associated landscape, hardscape, paving and utility services. The project will include airport hangars, industrial buildings, office buildings and single family and multi-family residential housing.

The project proposes an 8-inch DIP waterline to run through the Site to provide water services and fire flow. The new waterline will connect to the existing water infrastructure at four (4) locations: the 12-inch ACP waterline to the north of the Site in Redfield Road, two (2) locations at the 6-inch waterline to the south in Sutton Drive and the 8-inch DIP waterline to the East in Miller Road. A total of 17 proposed fire hydrants will be onsite for fire protection. Refer to the attached *Water Exhibit* for a depiction of the proposed waterline.

The design criteria used to estimate potable water demands and evaluate system hydraulics are based on Wood, Patel & Associates, Inc.'s (WOODPATEL) understanding of the requirements listed in the City of Scottsdale's *Design Standards and Policies manual*, 2018. The following is a summary of the primary design criteria utilized:

- Average Day Water Demand, Office..... 8.34E-04 gpm/sf
- Average Day Water Demand, Industrial 1.44 gpm/acre
- Average Day Water Demand, Multi-Family Residential..... 0.3 gpm/DU
- Fire Flow Requirements min. 1,500 gpm
- Maximum Day Demand 2.0 x ADD
- Peak Hour Demand..... 3.5 x ADD
- Minimum Residual Pressure, Peak Hour 5 psi
- Minimum Residual Pressure, Maximum Day + Fire Flow 30 psi
- Maximum System Pressure 120 psi
- Maximum Pipe Head Loss, Maximum day Demand..... 8ft/1000ft
- Maximum Pipe Head Loss, Peak Hour Demand 10ft/1000ft
- Minimum Pipe Diameter, Public Water Line 8 inches

Abbreviations: gpd = gallons per day; sf = square feet; ADD = average day demand; psi = pounds per square inch; gpm = gallons per minute

*Includes both inside and outside use per Figure 6-1.2, *COS Design Standards and Policies Manual*

**Fire flow is based on 10% reduction to account for flow measurement inaccuracy (refer to attached calculations in the appendices)

The water service and fire flow will be provided by the proposed 8-inch DIP waterline running through the Site. The average day water demand for the proposed Site is projected to be approximately 431.8 gpm. Maximum day demands and peak hour demands are projected to be 865.3 gpm and 1511.4 gpm, respectively (refer to attached calculations). *WaterCAD V8i*, by Haestad Methods, was utilized to analyze the existing water distribution system and proposed improvements. Results from a fire hydrant flow test, conducted on July 18, 2019 by Arizona Flow Testing LLC, was utilized to simulate the City of Scottsdale’s water supply for the Site (refer to attached modeling results).

The hydraulic modeling results indicate the proposed system is capable of delivering peak hour demands totaling 1511.4 gpm to the proposed Site, with pressures ranging from 26 to 37 psi. Fire flow results indicate residual pressures exceed 30 psi within the Site with 2,875 gpm fire hydrant flows during maximum day demand. A 50-percent reduction was applied to the fire flow requirements due to the proposed sprinkler system. Hydraulic modeling results, calculations and exhibits involved in the water system analysis are attached.

Thank you for your review of the Water Distribution System Basis of Design Report provided for 7th Day Adventist - Scottsdale & Sutton. Feel free to contact me if you have any questions.

Sincerely,

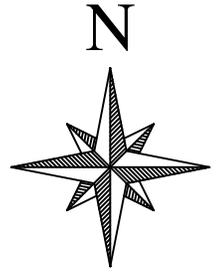
Wood, Patel & Associates, Inc.

Anthony J. Beuché, PE
Project Manager

AJB/se

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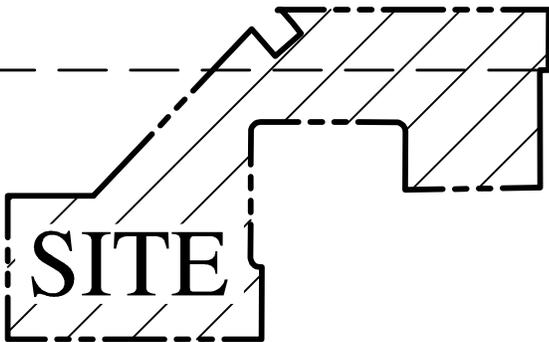
VICINITY MAP



S. 1/2 SECTION 11,
T.3N., R.4E.

SCOTTSDALE ROAD

HAYDEN ROAD



SITE

N. 1/2 SECTION 14,
T.3N., R.4E.

CACTUS ROAD

VICINITY MAP

N.T.S.

**NOT
FOR
CONSTRUCTION
OR RECORDING**



SEVENTH-DAY

VICINITY MAP EXHIBIT

DATE	07/26/2019	SCALE	N.T.S.	SHEET	## OF ##
JOB NO.	194966	DESIGN	TB	CHECK	LB
		DRAWN	JO	RFI #	

HYDRAULIC CALCULATIONS

TABLE 1 - WATER DESIGN CRITERIA

Project: SEVENTH DAY
Location: Scottsdale, Arizona
References: City of Scottsdale Design Standards & Policies Manual (2018)

Project Number: 194966
Project Engineer: Anthony J Beuche, P.E.

RESIDENTIAL WATER DEMANDS			
LAND USE	AVERAGE DAILY DEMAND (ADD)		NOTES
	VALUE	UNITS	
< 2 dwelling DU/ac	0.69	gpm/unit	Note 1
2-2.9 dwelling DU/ac	0.66	gpm/unit	Note 1
3-7.9 dwelling DU/ac	0.36	gpm/unit	Note 1
8-11.9 dwelling DU/ac	0.33	gpm/unit	Note 1
12-22 2 dwelling DU/ac	0.33	gpm/unit	Note 1
High Density Condominium (condo)	0.27	gpm/unit	Note 1
Resort Hotel (includes site amenities)	0.63	gpm/room	Note 1

NON-RESIDENTIAL WATER DEMANDS			
LAND USE	AVERAGE DAILY DEMAND (ADD)		NOTES
	VALUE	UNITS	
Restaurant	0.00181	gpm/sf	Note 1
Commercial/Retail	0.00111	gpm/sf	Note 1
Commercial High Rise	0.000834	gpm/sf	Note 1
Office	0.000834	gpm/sf	Note 1
Institutional	1.88	gpm/acre	Note 1
Industrial	1.44	gpm/acre	Note 1
Research and Development	1.79	gpm/acre	Note 1

LANDSCAPE WATER DEMANDS			
LAND USE	AVERAGE DAILY DEMAND (ADD)		NOTES
	VALUE	UNITS	
Natural Area Open Space	0.00	gpm/acre	Note 1
Developed Open Space - Parks	2.49	gpm/acre	Note 1
Developed Open Space - Golf Course	5.96	gpm/acre	Note 1

HYDRAULIC MODELING CRITERIA			
DESCRIPTION	VALUE	UNITS	NOTES
MAX DAY FLOW			
Max Day Flow = Peaking Factor (PF) x ADD	2 x ADD	gpm	Note 1
PEAK HOUR FLOW			
Peak Hour Flow = Peaking Factor (PF) x ADD	3.17 x ADD	gpm	Note 1
MODELED FIRE HYDRANT FLOW (MINIMUM)			
<input type="checkbox"/> Residential, 0 - 3,600 sf fire-flow calculation area	1,000	gpm	Note 3
<input type="checkbox"/> Residential, 3,601 - 4,800 sf fire-flow calculation area	1,750	gpm	Note 4
<input type="checkbox"/> Residential, 4,801 - 6,200 sf fire-flow calculation area	2,000	gpm	Note 4
<input type="checkbox"/> Residential, 6,201 - 7,700 sf fire-flow calculation area	2,250	gpm	Note 4
<input type="checkbox"/> Residential, 7,701 - 9,400 sf fire-flow calculation area	2,500	gpm	Note 4
<input type="checkbox"/> Residential, 9,401 - 11,300 sf fire-flow calculation area	2,750	gpm	Note 4
<input type="checkbox"/> Multi-Family Residential	-	gpm	Note 2
<input checked="" type="checkbox"/> Commercial	2,875	gpm	Note 2
HYDRAULICS			
Residual Pressure Range, Peak Hour	50-150	psi	Note 1
Minimum Residual Pressure, Max Day + Fire Flow (Hydrant TEE)	30	psi	Note 1
Minimum Residual Pressure, Max Day + Fire Flow (Domestic Service)	15	psi	Note 1
Minimum Pipe Diameter, Looped System	6	in	Note 1
Hazen-Williams C-value	120	-	Note 1

Notes:

1. Per City of Scottsdale Design Standards & Policies Manual (2018)
2. Per 2015 International Fire Code as adopted by the City of Scottsdale. Utilizes construction type A1, 292,931 sf area (all office & retail areas, excludes garage areas), 50% reduction applied.
3. Residential limited to one- and two-family dwellings, assumes Type V-B construction, and has a 1-hour fire duration
4. Residential limited to one- and two-family dwellings, assumes Type V-B construction, and has a 2-hour fire duration

TABLE 2 - WATER DEMAND DESIGN FLOWS

Project: SEVENTH DAY
 Location: Scottsdale, Arizona
 References: City of Scottsdale Design Standards & Policies Manual (2018)

Project Number: 194966
 Project Engineer: Anthony J Beuche, P.E.

Water Demand Calculations

HYDRAULIC MODEL NODE	ELEVATION (ft)	PRESSURE ZONE	LAND USE	APPLICABLE UNIT	NUMBER OF UNITS	ADD/APPLICABLE UNIT	GPM/APPLICABLE UNIT ¹	AVERAGE DAILY DEMAND			MAX DAY DEMAND		PEAK HOUR DEMAND		Fire Flow (gpm)
								(gpd)	(gpm)	Total (gpm)	(gpm)	Total (gpm)	(gpm)	Total (gpm)	
J-30	1,430.6	1	Office	gpd/sf	508,100	0.6	0.00083	304,860	421.7	421.7	843.4	843.4	1,336.8	1,336.8	2875
J-30	1,430.6	1	Industrial	gpd/ac	3.38	1,008.0	1.4	3,407	4.7	426.4	14.9	858.3	16.5	1,353.3	0
J-14	1,430.6		Multi-Family Residential	gpd/DU	18.00	216.0	0.3	3,888	5.4	431.8	5.4	863.7	18.9	1,372.2	0
								312155.0	431.8	431.8	863.7	863.7	1372.2	1372.2	2875.0

Notes:

- GPM values are based on a 12-hour active water used period per 24-hour day per the City of Scottsdale Design Standards and Policy Manual.
- Average daily water demand for the Galleria was calculated from the monthly water meter billing report for July 2018. July 2018 had the highest water usage of all meter billing reports received from January 2018 to October 2018. Meter billing reports provided by client.

EXISTING WATER SYSTEM PRESSURES

Project: SEVENTH DAY
Location: Scottsdale, Arizona

Project Number: 194966
Project Engineer: Anthony J Beuche, P.E.

Flow Test Location:

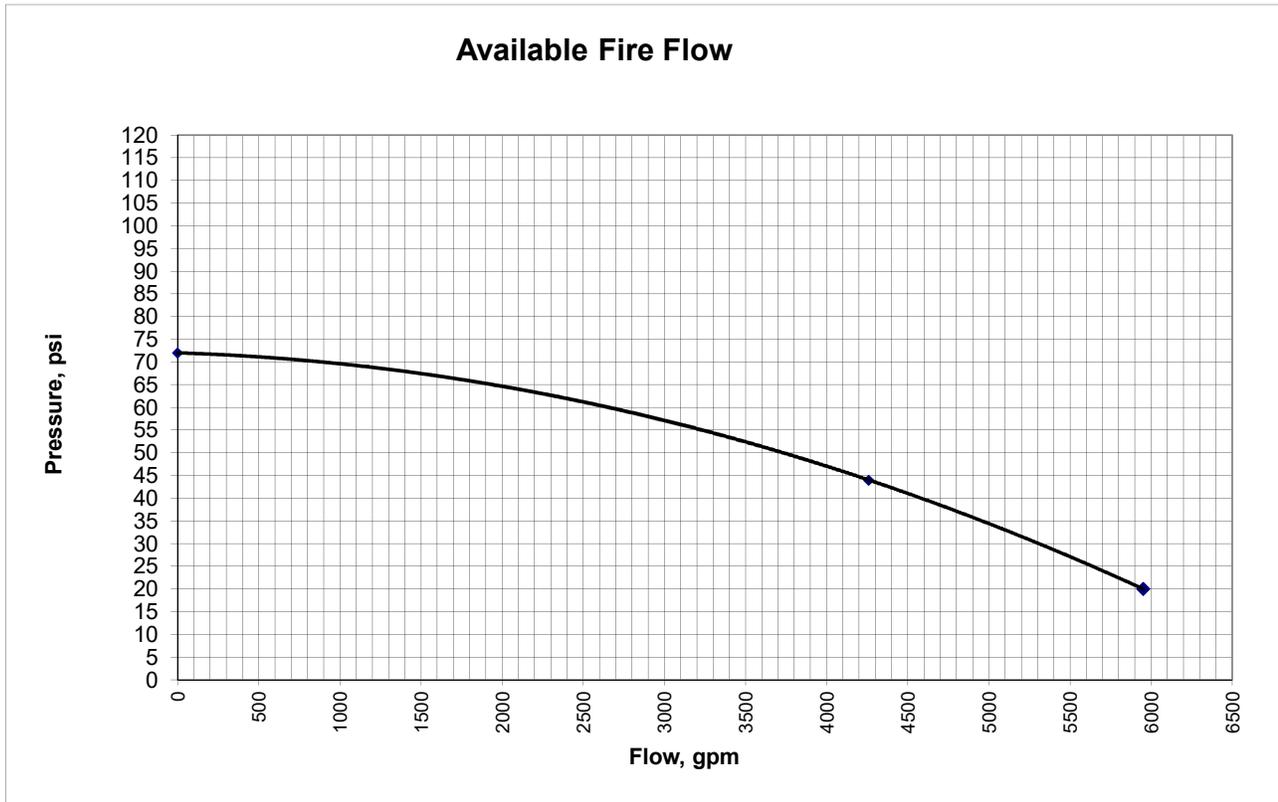
Date of Flow Test:

Pressure Hydrant

Static Pressure (psi) 72.0
Residual Pressure (psi) 44.0
Calculated Flow at 20 psi 5951 gpm

Flow Hydrant

Flow (gpm) 4260
Calculated Flow at 20 psi 20



Discharge (gpm)	Pressure (psi)	Head (ft)
0	72	166.2
4260	44	101.6
5951	20	46.2

Notes:

1. Values provided from a flow test by the Arizona Flow Testing, LLC

Arizona Flow Testing LLC

HYDRANT FLOW TEST REPORT

Project Name:	7th Day Adventist
Project Address:	Scottsdale Road & Sutton Drive, Scottsdale, Arizona, 85254
Client Project No.:	194966
Arizona Flow Testing Project No.:	19272
Flow Test Permit No.:	C58918
Date and time flow test conducted:	July 18, 2019 at 7:00 AM
Data is current and reliable until:	January 18, 2020
Conducted by:	F. Vaughan & T. Atherton – Az. Flow Testing, LLC (480-250-8154)
Coordinated by:	Jared Berry – City of Scottsdale-Inspector (602-541-4942)

Raw Test Data

Static Pressure: **94.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **66.0 PSI**
(Measured in pounds per square inch)

Pitot Pressure: **36.0 PSI Hyd A**
20.0 PSI Hyd B
(Measured in pounds per square inch)

Diffuser Orifice Diameter: One 4-inch Hose Monster (B)
(Measured in inches) One 4 inch Pollard Diffuser (A)

Coefficient of Diffuser: 0.7875/(B) and 0.9/(A)

Flowing GPM: **4,260 GPM**
(Measured in gallons per minute)
2,578 GPM + 1,682 GPM = 4,260 GPM

GPM @ 20 PSI: **7,201 GPM**

Data with 22 PSI Safety Factor

Static Pressure: **72.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **44.0 PSI**
(Measured in pounds per square inch)

Distance between hydrants: See Below

Main size: Not Provided

Flowing GPM: **4,260 GPM**

GPM @ 20 PSI: **5,952 GPM**

Scottsdale requires a maximum Static Pressure of 72 PSI for AFES Design.

Flow Test Location



FlexTable: Junction Table

ID	Label	Elevation (ft)	Hydraulic Grade (ft)	Pressure (psi)	Demand (gpm)
30	J-15	1,416.00	1,524.29	47	0
33	J-3	1,416.56	(N/A)	(N/A)	(N/A)
35	FH-1	1,417.74	(N/A)	(N/A)	(N/A)
37	FH-2	1,420.79	(N/A)	(N/A)	(N/A)
39	FH-3	1,419.33	(N/A)	(N/A)	(N/A)
41	FH-4	1,422.56	(N/A)	(N/A)	(N/A)
43	J-8	1,423.28	(N/A)	(N/A)	(N/A)
45	FH-5	1,422.90	(N/A)	(N/A)	(N/A)
47	FH-6	1,421.53	(N/A)	(N/A)	(N/A)
49	FH-7	1,419.13	(N/A)	(N/A)	(N/A)
53	FH-10	1,416.88	(N/A)	(N/A)	(N/A)
61	FH-12	1,427.09	(N/A)	(N/A)	(N/A)
63	FH-13	1,428.34	(N/A)	(N/A)	(N/A)
67	FH-14	1,428.77	(N/A)	(N/A)	(N/A)
69	FH-15	1,427.51	(N/A)	(N/A)	(N/A)
71	FH-16	1,428.92	(N/A)	(N/A)	(N/A)
73	FH-17	1,429.43	(N/A)	(N/A)	(N/A)
75	FH-18	1,426.57	(N/A)	(N/A)	(N/A)
85	EX FH-1	1,426.18	1,524.29	42	0
86	J-10	1,417.00	1,524.29	46	0
89	EX FH-2	1,416.00	1,524.29	47	0
91	EX FH-3	1,417.00	1,524.29	46	0
93	J-20	1,417.00	1,524.29	46	0
95	EX FH-4	1,418.00	1,524.29	46	0
97	EX FH-5	1,420.00	1,524.29	45	0
99	J-25	1,425.89	1,524.29	43	0
102	FH-FLOW TEST	1,434.00	1,535.84	44	0
104	FH-FLOW A	1,432.00	1,524.29	40	4,260
107	FH-FLOW B	1,437.00	1,535.84	43	0
109	J-5	1,425.67	1,524.29	43	0
113	J-35	1,428.39	(N/A)	(N/A)	(N/A)
130	J-30	1,430.55	1,524.29	41	0
152	J-41	1,417.00	1,524.29	46	0
155	J-42	1,422.00	(N/A)	(N/A)	(N/A)
161	FH-09	1,422.12	(N/A)	(N/A)	(N/A)
165	FH-11	1,425.00	(N/A)	(N/A)	(N/A)

FlexTable: Junction Table

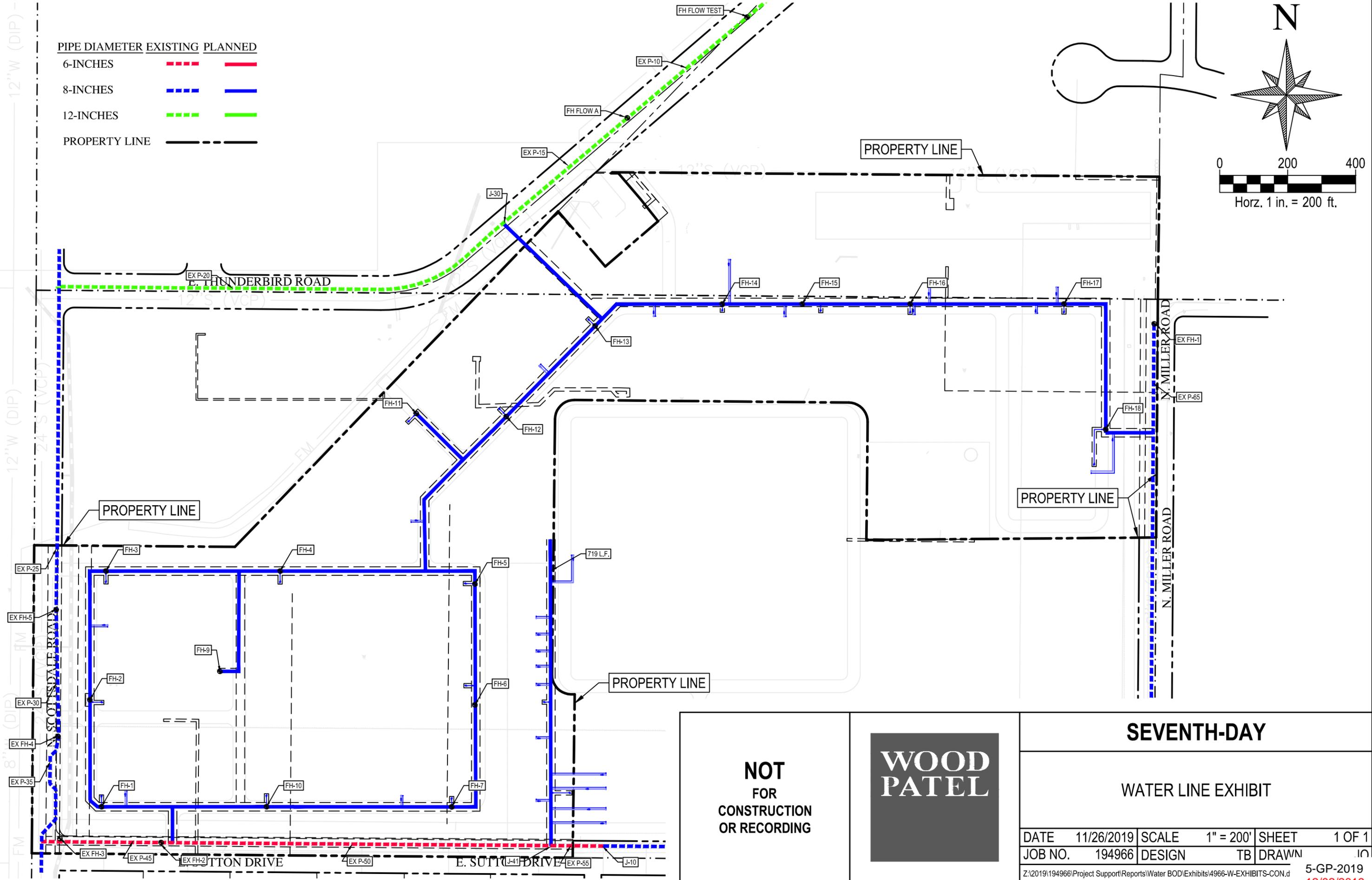
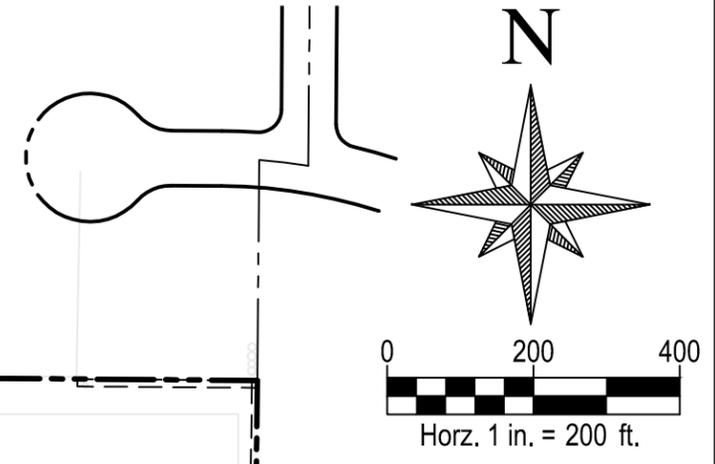
ID	Label	Elevation (ft)	Hydraulic Grade (ft)	Pressure (psi)	Demand (gpm)
30	J-15	1,416.00	1,600.52	80	0
33	J-3	1,416.56	(N/A)	(N/A)	(N/A)
35	FH-1	1,417.74	(N/A)	(N/A)	(N/A)
37	FH-2	1,420.79	(N/A)	(N/A)	(N/A)
39	FH-3	1,419.33	(N/A)	(N/A)	(N/A)
41	FH-4	1,422.56	(N/A)	(N/A)	(N/A)
43	J-8	1,423.28	(N/A)	(N/A)	(N/A)
45	FH-5	1,422.90	(N/A)	(N/A)	(N/A)
47	FH-6	1,421.53	(N/A)	(N/A)	(N/A)
49	FH-7	1,419.13	(N/A)	(N/A)	(N/A)
53	FH-10	1,416.88	(N/A)	(N/A)	(N/A)
61	FH-12	1,427.09	(N/A)	(N/A)	(N/A)
63	FH-13	1,428.34	(N/A)	(N/A)	(N/A)
67	FH-14	1,428.77	(N/A)	(N/A)	(N/A)
69	FH-15	1,427.51	(N/A)	(N/A)	(N/A)
71	FH-16	1,428.92	(N/A)	(N/A)	(N/A)
73	FH-17	1,429.43	(N/A)	(N/A)	(N/A)
75	FH-18	1,426.57	(N/A)	(N/A)	(N/A)
85	EX FH-1	1,426.18	1,600.52	75	0
86	J-10	1,417.00	1,600.52	79	0
89	EX FH-2	1,416.00	1,600.52	80	0
91	EX FH-3	1,417.00	1,600.52	79	0
93	J-20	1,417.00	1,600.52	79	0
95	EX FH-4	1,418.00	1,600.52	79	0
97	EX FH-5	1,420.00	1,600.52	78	0
99	J-25	1,425.89	1,600.52	76	0
102	FH-FLOW TEST	1,434.00	1,600.52	72	0
104	FH-FLOW A	1,432.00	1,600.52	73	0
107	FH-FLOW B	1,437.00	1,600.52	71	0
109	J-5	1,425.67	1,600.52	76	0
113	J-35	1,428.39	(N/A)	(N/A)	(N/A)
130	J-30	1,430.55	1,600.52	74	0
152	J-41	1,417.00	1,600.52	79	0
155	J-42	1,422.00	(N/A)	(N/A)	(N/A)
161	FH-09	1,422.12	(N/A)	(N/A)	(N/A)
165	FH-11	1,425.00	(N/A)	(N/A)	(N/A)

FlexTable: Junction Table

ID	Label	Elevation (ft)	Hydraulic Grade (ft)	Pressure (psi)	Demand (gpm)
30	J-15	1,416.00	1,488.39	31	0
33	J-3	1,416.56	1,488.39	31	0
35	FH-1	1,417.74	1,488.39	31	0
37	FH-2	1,420.79	1,488.39	29	0
39	FH-3	1,419.33	1,488.39	30	0
41	FH-4	1,422.56	1,488.39	28	0
43	J-8	1,423.28	1,488.39	28	0
45	FH-5	1,422.90	1,488.39	28	0
47	FH-6	1,421.53	1,488.39	29	0
49	FH-7	1,419.13	1,488.39	30	0
53	FH-10	1,416.88	1,488.39	31	0
61	FH-12	1,427.09	1,488.39	27	0
63	FH-13	1,428.34	1,488.39	26	0
67	FH-14	1,428.77	1,488.39	26	0
69	FH-15	1,427.51	1,488.39	26	0
71	FH-16	1,428.92	1,488.39	26	0
73	FH-17	1,429.43	1,488.39	26	0
75	FH-18	1,426.57	1,488.39	27	0
85	EX FH-1	1,426.18	1,488.39	27	0
86	J-10	1,417.00	1,488.39	31	0
89	EX FH-2	1,416.00	1,488.39	31	0
91	EX FH-3	1,417.00	1,488.39	31	0
93	J-20	1,417.00	1,488.39	31	0
95	EX FH-4	1,418.00	1,488.39	30	0
97	EX FH-5	1,420.00	1,488.39	30	0
99	J-25	1,425.89	1,488.39	27	0
102	FH-FLOW TEST	1,434.00	1,520.13	37	0
104	FH-FLOW A	1,432.00	1,505.77	32	0
107	FH-FLOW B	1,437.00	1,520.13	36	0
109	J-5	1,425.67	1,488.39	27	0
113	J-35	1,428.39	1,488.39	26	0
130	J-30	1,430.55	1,488.39	25	4,791
152	J-41	1,417.00	1,488.39	31	0
155	J-42	1,422.00	1,488.39	29	0
161	FH-09	1,422.12	1,488.39	29	0
165	FH-11	1,425.00	1,488.39	27	0

WATER EXHIBIT

PIPE DIAMETER	EXISTING	PLANNED
6-INCHES		
8-INCHES		
12-INCHES		
PROPERTY LINE		



**NOT
FOR
CONSTRUCTION
OR RECORDING**



SEVENTH-DAY			
WATER LINE EXHIBIT			
DATE	11/26/2019	SCALE	1" = 200'
JOB NO.	194966	DESIGN	TB
SHEET		1 OF 1	
DRAWN		JG	
Z:\2019\194966\Project Support\Reports\Water BOD\Exhibits\4966-W-EXHIBITS-CON.d			
5-GP-2019 12/02/2019			

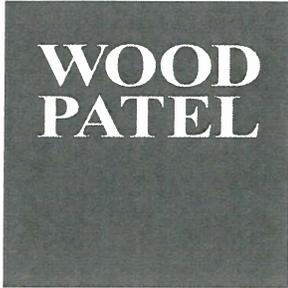
-You must include a copy of a current Hydrant test. You provided the flow graph but nothing which shows raw data from the test. DSPM 6-1.202 AHB 9/10/19. Could you also please explain how/why you determined which hydrants to use for the analysis?

-You need to show relevant appurtenances on the water exhibit or map DSPM 6-1.202 AHB 9/10/19

-How did you determine your required fire flow? This is a large development. Please explain DSPM 6-1.202 AHB 9/10/19

- Please see SRC 36-18 for requirements for sprinkler systems. AHB 9/10/19

-You have shown a dead end line with no length specified. See DSPM 6-1.403 AHB 9/10/19



PRELIMINARY Basis of Design Report <input type="checkbox"/> ACCEPTED <input type="checkbox"/> ACCEPTED AS NOTED <input checked="" type="checkbox"/> REVISE AND RESUBMIT	Reviewed by  On behalf of the Scottsdale Water Resources Planning and Engineering Department
<p>DISCLAIMER: If accepted, the preliminary approval is granted under the condition that a final basis of design report will also be submitted for city review and approval (Typically during the DR and PP case). The final report shall incorporate further water or sewer design and analysis requirements as defined in the city design standards and policy manual and address those items noted in the preliminary review comments (both separate and included herein). The final report shall be submitted and approved prior to the plan review submission. For questions and clarifications contact the Water Resources Planning and Engineering Department at 480-321-5685</p>	
REVIEWER: Andrew Buell DATE EMAIL: abuell@carollo.com 09/10/2019	

**WATER DISTRIBUTION SYSTEM
BASIS OF DESIGN REPORT
FOR
7th DAY ADVENTIST – SCOTTSDALE & SUTTON**

August 2, 2019
WP# 194966





August 2, 2019

2051 W Northern Ave #100
Phoenix AZ 85021
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Re: **7th Day Adventist – Scottsdale & Sutton**
Water Distribution System Basis of Design Report
WP# 194966

To Whom It May Concern:

This Water Distribution System Basis of Design Report is prepared for Ryan A+E, Inc., and submitted to the City of Scottsdale. 7th Day Adventist – Scottsdale & Sutton (Site) consists of portions of two (2) adjacent parcels totaling an area of approximately 2,148,604 square-feet, or 49.3± acres, located at the northeast corner of North Scottsdale Road and Sutton Road in Scottsdale, Arizona. More specifically, the Site is located in a portion of Section 11, Township 3 North, Range 4 East and a portion of the north half of Section 14, Township 3 North, Range 4 East of the Gila and Salt River Base and Meridian. Refer to the *Vicinity Map* at the back of this report. The Site is bounded by Thunderbird Road/Redfield Road to the north, East Sutton Drive on the south, North Miller Road on the east and North Scottsdale Road on the west. The project will include construction of airport hangars, industrial buildings, office buildings, residential townhomes, and single family homes. Proposed improvements include associated landscape, hardscape, paving and utility services. The project will include airport hangars, industrial buildings, office buildings and single family and multi-family residential housing.

Pipe material?

The project proposes an 8-inch DIP waterline to run through the Site to provide water services and fire flow. The new waterline will connect to the existing water infrastructure at three (3) locations: the 12-inch ACP waterline to the north of the Site in Redfield Road, the 6-inch waterline to the south in Sutton Drive and the 8-inch DIP waterline to the East in Miller Road. A total of 18 proposed fire hydrants will be onsite for fire protection. Refer to the attached *Water Exhibit* for a depiction of the proposed waterline.

The design criteria used to estimate potable water demands and evaluate system hydraulics are based on Wood, Patel & Associates, Inc.'s (WOODPATEL) understanding of the requirements listed in the City of Scottsdale's *Design Standards and Policies manual*, 2018. The following is a summary of the primary design criteria utilized:

- Average Day Water Demand, Office.....8.34E-04 gpm/sf
- Average Day Water Demand, Industrial.....1.44 gpm/acre
- Average Day Water Demand, Multi-Family Residential0.3 gpm/DU
- Fire Flow Requirementsmin. 1,500 gpm
- Maximum Day Demand2.0 x ADD
- Peak Hour Demand3.5 x ADD
- Minimum Residual Pressure, Peak Hour.....5 psi
- Minimum Residual Pressure, Maximum Day + Fire Flow30 psi
- Maximum System Pressure.....120 psi
- Maximum Pipe Head Loss, Maximum day Demand8ft/1000ft
- Maximum Pipe Head Loss, Peak Hour Demand.....10ft/1000ft
- Minimum Pipe Diameter, Public Water Line8 inches

Abbreviations: gpd = gallons per day; sf = square feet; ADD = average day demand; psi = pounds per square inch; gpm = gallons per minute

*Includes both inside and outside use per Figure 6-1.2, *COS Design Standards and Policies Manual*

**Fire flow is based on 10% reduction to account for flow measurement inaccuracy (refer to attached calculations in the appendices)

The water service and fire flow will be provided by the proposed 8-inch DIP waterline running through the Site. The average day water demand for the proposed Site is projected to be approximately 539.7 gpm. Maximum day demands and peak hour demands are projected to be 1082.9 gpm and 1889.0 gpm, respectively (refer to attached calculations). *WaterCAD V8i*, by Haestad Methods, was utilized to analyze the existing water distribution system and proposed improvements. Results from a fire hydrant flow test, conducted on July 18, 2019 by Arizona Flow Testing LLC, was utilized to simulate the City of Scottsdale's water supply for the Site (refer to attached modeling results).

The hydraulic modeling results indicate the proposed system is capable of delivering peak hour demands totaling 1889.0 gpm to the proposed Site, with pressures ranging from 66 to 73 psi. Fire flow results indicate residual pressures exceed 30 psi within the Site with 2,875 gpm fire hydrant flows during maximum day demand. A 50-percent reduction was applied to the fire flow requirements due to the proposed sprinkler system. Hydraulic modeling results, calculations and exhibits involved in the water system analysis are attached.

Thank you for your review of the Water Distribution System Basis of Design Report provided for 7th Day Adventist - Scottsdale & Sutton. Feel free to contact me if you have any questions.

Sincerely,

Wood, Patel & Associates, Inc.



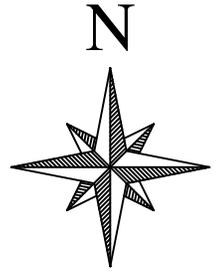
You did not include any modeling results or tables

Anthony J. Beuché, PE
Project Manager

AJB/se

se
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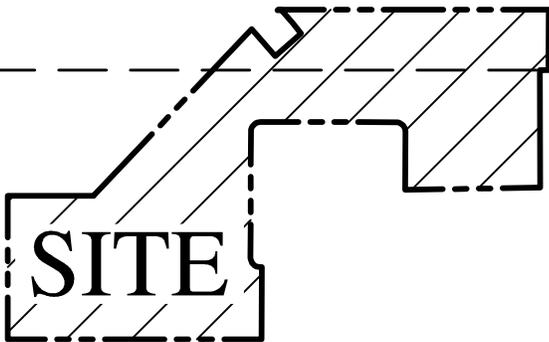
VICINITY MAP



S. 1/2 SECTION 11,
T.3N., R.4E.

SCOTTSDALE ROAD

HAYDEN ROAD



SITE

N. 1/2 SECTION 14,
T.3N., R.4E.

CACTUS ROAD

VICINITY MAP

N.T.S.

**NOT
FOR
CONSTRUCTION
OR RECORDING**



SEVENTH-DAY

VICINITY MAP EXHIBIT

DATE	07/26/2019	SCALE	N.T.S.	SHEET	## OF ##
JOB NO.	194966	DESIGN	TB	CHECK	LB
		DRAWN	JO	RFI #	

HYDRAULIC CALCULATIONS

TABLE 1 - WATER DESIGN CRITERIA

Project: SEVENTH DAY
Location: Scottsdale, Arizona
References: City of Scottsdale Design Standards & Policies Manual (2018)

Project Number: 194966
Project Engineer: Anthony J Beuche, P.E.

carry these out to values shown in table

RESIDENTIAL WATER DEMANDS			
LAND USE	AVERAGE DAILY DEMAND (ADD)		NOTES
	VALUE	UNITS	
< 2 dwelling DU/ac	0.7	gpm/unit	Note 1
2-2.9 dwelling DU/ac	0.7	gpm/unit	Note 1
3-7.9 dwelling DU/ac	0.4	gpm/unit	Note 1
8-11.9 dwelling DU/ac	0.3	gpm/unit	Note 1
12-22.2 dwelling DU/ac	0.3	gpm/unit	Note 1
High Density Condominium (condo)	0.3	gpm/unit	Note 1
Resort Hotel (includes site amenities)	0.6	gpm/unit	Note 1

GPM/Room

NON-RESIDENTIAL WATER DEMANDS			
LAND USE	AVERAGE DAILY DEMAND (ADD)		NOTES
	VALUE	UNITS	
Restaurant	0.00181	gpm/sf	Note 1
Commercial/Retail	0.00111	gpm/sf	Note 1
Commercial High Rise	0.000834	gpm/sf	Note 1
Office	0.000834	gpm/sf	Note 1
Institutional	1.88	gpm/acre	Note 1
Industrial	1.44	gpm/acre	Note 1
Research and Development	1.79	gpm/acre	Note 1

LANDSCAPE WATER DEMANDS			
LAND USE	AVERAGE DAILY DEMAND (ADD)		NOTES
	VALUE	UNITS	
Natural Area Open Space	0	gpm/acre	Note 1
Developed Open Space - Parks	2	gpm/acre	Note 1
Developed Open Space - Golf Course	6	gpm/acre	Note 1

2.49

5.96

HYDRAULIC MODELING CRITERIA			
DESCRIPTION	VALUE	UNITS	NOTES
MAX DAY FLOW			
Max Day Flow = Peaking Factor (PF) x ADD	2 x ADD	gpm	Note 1
PEAK HOUR FLOW			
Peak Hour Flow = Peaking Factor (PF) x ADD	3.5 x ADD	gpm	Note 1
MODELED FIRE HYDRANT FLOW (MINIMUM)			
<input type="checkbox"/> Residential, 0 - 3,600 sf fire-flow calculation area	1,000	gpm	Note 3
<input type="checkbox"/> Residential, 3,601 - 4,800 sf fire-flow calculation area	1,750	gpm	Note 4
<input type="checkbox"/> Residential, 4,801 - 6,200 sf fire-flow calculation area	2,000	gpm	Note 4
<input type="checkbox"/> Residential, 6,201 - 7,700 sf fire-flow calculation area	2,250	gpm	Note 4
<input type="checkbox"/> Residential, 7,701 - 9,400 sf fire-flow calculation area	2,500	gpm	Note 4
<input type="checkbox"/> Residential, 9,401 - 11,300 sf fire-flow calculation area	2,750	gpm	Note 4
<input type="checkbox"/> Multi-Family Residential	-	gpm	Note 2
<input checked="" type="checkbox"/> Commercial	2,875	gpm	Note 2
HYDRAULICS			
Residual Pressure Range, Peak Hour	50-150	psi	Note 1
Minimum Residual Pressure, Max Day + Fire Flow (Hydrant TEE)	30	psi	Note 1
Minimum Residual Pressure, Max Day + Fire Flow (Domestic Service)	15	psi	Note 1
Minimum Pipe Diameter, Looped System	6	in	Note 1
Hazen-Williams C-value	120	-	Note 1

Notes:

- Per City of Scottsdale Design Standards & Policies Manual (2018)
- Per 2015 International Fire Code as adopted by the City of Scottsdale. Utilizes construction type A1, 292,931 sf area (all office & retail areas, excludes garage areas), 50% reduction applied.
- Residential limited to one- and two-family dwellings, assumes Type V-B construction, and has a 1-hour fire duration
- Residential limited to one- and two-family dwellings, assumes Type V-B construction, and has a 2-hour fire duration

Are you going to use IFC to calculate flow? See SRC 36-18 for sprinkler requirements

TABLE 2 - WATER DEMAND DESIGN FLOWS

Project: SEVENTH DAY
 Location: Scottsdale, Arizona
 References: City of Scottsdale Design Standards & Policies Manual (2018)

Project Number: 194966
 Project Engineer: Anthony J Beuche, P.E.

Water Demand Calculations

HYDRAULIC MODEL NODE	ELEVATION (ft)	PRESSURE ZONE	LAND USE	APPLICABLE UNIT	NUMBER OF UNITS	ADD/APPLICABLE UNIT	GPM/APPLICABLE UNIT ¹	AVERAGE DAILY DEMAND			MAX DAY DEMAND		PEAK HOUR DEMAND		Fire Flow (gpm)
								(gpd)	(gpm)	Total (gpm)	(gpm)	Total (gpm)	(gpm)	Total (gpm)	
J-30	1,430.6	1	Office	gpd/sf	636,650	0.6	0.00083	381,990	528.4	528.4	1,056.8	1,056.8	1,849.4	1,849.4	2875
J-30	1,430.6	1	Industrial	gpd/ac	4.23	1,008.0	1.4	4,264	5.9	534.3	20.7	1,077.5	20.7	1,870.1	0
J-30	1,430.6		Multi-Family Residential	gpd/DU	18.00	216.0	0.3	3,888	5.4	539.7	5.4	1,082.9	18.9	1,889.0	0
								390142.0	539.7	539.7	1082.9	1082.9	1889.0	1889.0	2875.0

Notes:

- GPM values are based on a 12-hour active water used period per 24-hour day per the City of Scottsdale Design Standards and Policy Manual.
- Average daily water demand for the Galleria was calculated from the monthly water meter billing report for July 2018. July 2018 had the highest water usage of all meter billing reports received from January 2018 to October 2018. Meter billing reports provided by client.

EXISTING WATER SYSTEM PRESSURES

Project: SEVENTH DAY
Location: Scottsdale, Arizona

Project Number: 194966
Project Engineer: Anthony J Beuche, P.E.

Flow Test Location:

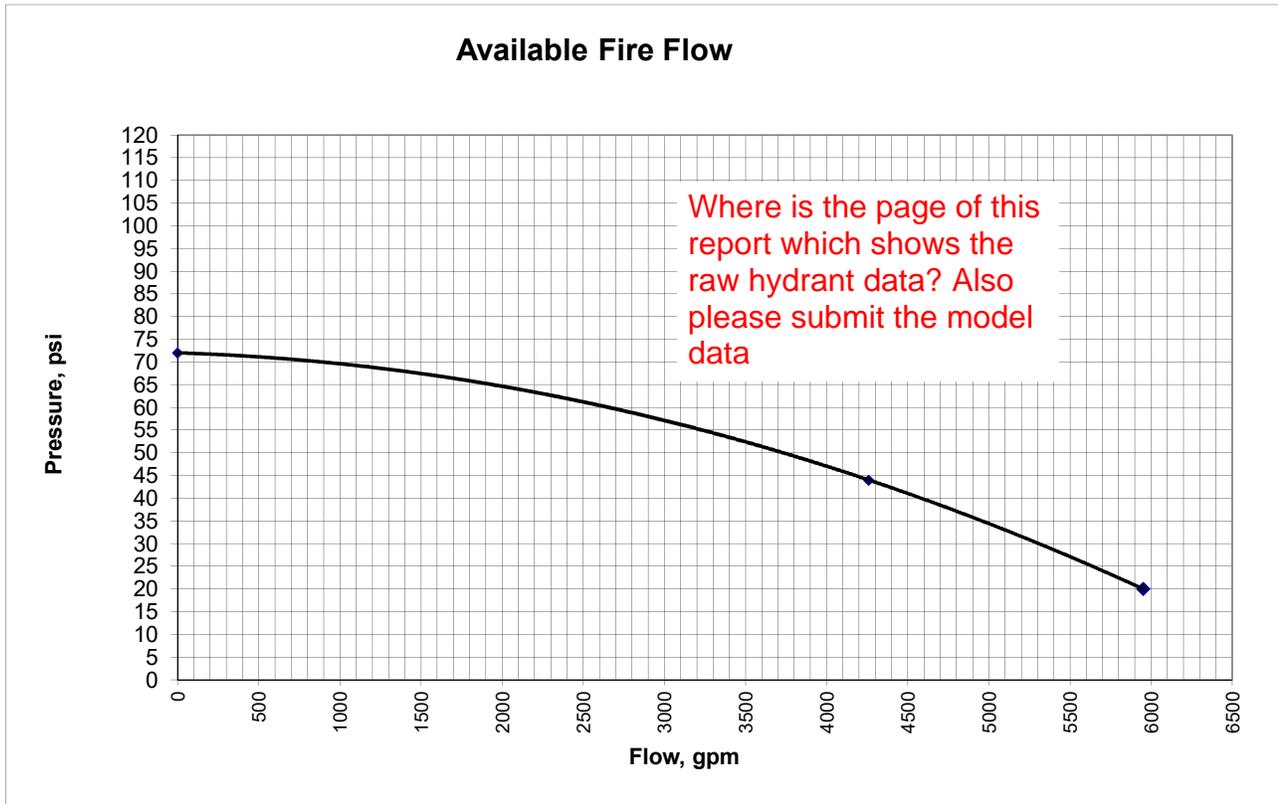
Date of Flow Test:

Pressure Hydrant

Static Pressure (psi) 72.0
Residual Pressure (psi) 44.0
Calculated Flow at 20 psi 5951 gpm

Flow Hydrant

Flow (gpm) 4260
Calculated Flow at 20 psi 20



Discharge (gpm)	Pressure (psi)	Head (ft)
0	72	166.2
4260	44	101.6
5951	20	46.2

Notes:

1. Values provided from a flow test by the Arizona Flow Testing, LLC

WATER EXHIBIT

PIPE DIAMETER EXISTING PLANNED
 6-INCHES ---
 8-INCHES ---
 12-INCHES ---
 PROPERTY LINE - - -

Can you please explain why you used these three hydrants to conduct the hydrant test?

Dead End Line. See DSPM 6-1.403

How long this segment of pipe??

I count 4 connections and the report says 3. Please clarify

NOT FOR CONSTRUCTION OR RECORDING



SEVENTH DAY

WATERLINE EXHIBIT

DATE	07-31-2019	SCALE	1" = 120'	SHEET	1 OF 1
JOB NO.	194966	DESIGN	TB	DRAWN	LB

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